

REMARKS

The Communication mailed September 21, 2007, in the above-identified application, is noted. In this Communication, in Item 2 on page 2 thereof, it is contended by the Examiner that claims as amended in the Amendment filed September 12, 2007, are directed to a species that is distinct from that originally elected, in that the original election (in the Response filed October 19, 2006), elected "the absence of the filler component". In view thereof, the Examiner indicated on page 4 of this Communication mailed September 21, 2007, that the Amendment filed September 12, 2007, is not fully responsive to the non-final rejection; and the Examiner gave Applicants one (1) month (extendible) to file a fully responsive Amendment or other response.

In view of the foregoing, Applicants are amending their claims herein, such that the present amendments are fully responsive. Thus, Applicants are amending claim 1 to recite that the adhesive sheet comprises the specified polymer component, which includes acrylic rubber having the specified glass transition temperature and weight-average molecular weight. Applicants have further amended claim 1, as compared with the last entered amendment of claim 1, to recite, in a "wherein" clause, that the adhesive sheet has a property that it can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing.

As compared with claim 1 as proposed to be amended in the Amendment filed September 12, 2007, present claim 1 does not recite a filler (is silent as to a filler). Claims 2-4 and 7 are being amended herein as they were amended in the Amendment filed September 12, 2007, with claim 7 being further amended to delete the language

“from which the weight of a filler is removed”. Claims 50-53 correspond respectively to claims 46-49 as proposed to be added in the Amendment filed September 12, 2007, with the change that the expression “from which the weight of a filler is removed” is not set forth in claims 50 and 51 (as compared with previously submitted (non-entered) claims 46 and 47).

As with the Amendment submitted September 12, 2007, by the present amendments Applicants are cancelling claims 8, 9 and 12-43 without prejudice or disclaimer.

By the present amendments, all of the claims are silent with respect to presence of a filler; that is, none of the claims affirmatively recite the presence of a filler. In view thereof, it is respectfully submitted that all of the claims presently in the application are directed to the originally elected species, and it is respectfully submitted that the present amendments are to be entered and the above-identified application examined responsive thereto.

The comment by the Examiner in Item 1 on page 2 of the Communication mailed September 21, 2007, that the “preamble language of claim 1 along with new claims 44-49 are supported by the specification” are noted. Noting that what the Examiner has alleged to be the “preamble language of claim 1” is now set forth in a “wherein” clause in claim 1, it is respectfully submitted that presently amended claim 1, as well as the other presently amended claims, and newly added claims 50-53, are supported by the specification.

The contention by the Examiner in Item 3 on page 2 of the Communication mailed September 21, 2007, that the Terminal Disclaimer filed September 12, 2007 does not overcome the obviousness-type double patenting rejections, until the fee has

been submitted”, is noted. Apparently, such “fee” referred to by the Examiner is the fee for the Terminal Disclaimer. However, it is respectfully submitted that the fee for the Terminal Disclaimer was submitted September 12, 2007, upon filing the Amendment on September 12, 2007. In this regard, attached please find a copy of the Electronic Patent Application Fee Transmittal for the above-identified application, in connection with the Amendment filed September 12, 2007, therein. Also enclosed is the Electronic Acknowledgement Receipt in connection with filing of this Amendment on September 12, 2007. As can be seen in the enclosed Electronic Acknowledgement Receipt, a payment of \$1,150 was successfully received; and as seen in the Electronic Patent Application Fee Transmittal, such fee of \$1,150 was for a three-month extension of time and \$130 for a processing fee, which is the fee for the Terminal Disclaimer. Thus, it is respectfully submitted that the fee for the Terminal Disclaimer submitted September 12, 2007, has already been successfully received in the U.S. Patent and Trademark Office. If necessary, such Terminal Disclaimer submitted September 12, 2007, is incorporated in the present Amendment by reference, again noting that the fee in connection therewith has already been paid. In view of all of the foregoing, it is respectfully submitted that the obviousness-type double patenting rejections in the Office Action mailed March 12, 2007, have clearly been overcome, and no further discussion in connection therewith is necessary, except to add that Applicants incorporate herein by reference contentions made in connection with the obviousness-type double patenting rejections as in the paragraph bridging pages 7 and 8, and first full paragraph on page 8, of the Amendment filed September 12, 2007.

In addition, the undersigned notes comments by the Examiner in Item 6 on page 4 of the Communication mailed September 21, 2007. In view thereof, it is

respectfully submitted that the rejection over Japanese Document No. 2002-280494 should be withdrawn, and no further discussion of the merits of this rejection will be set forth herein.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed March 12, 2007, that is, the teachings of the U.S. patent documents to Inada, et al., No. 5,965,269, to Tomiyama, et al., No. 7,070,670, to Yanagiuchi, et al., No. 6,521,337, to Shimada, et al., No. 6,090,468, to Tanaka, et al., No. 6,673,441, and to Teiichi, et al., Patent Application Publication No. 2003/0069331, and the Japanese patent documents No. 09-298369, No. 09-302313, No. 2000-248025, and No. 2002-060716, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such an adhesive sheet as in the present claims, having a polymer component that includes acrylic rubber having a glass transition temperature and weight-average molecular weight as recited in claim 1, the adhesive sheet having a breaking strength in the B-stage of from 0.1 to 10 MPa at 25°C, and a breaking elongation from 1-40% at 25°C, the adhesive sheet having the property that it can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing. See claim 1.

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such adhesive sheet as in the present claims, laminated together with the dicing tape onto the wafer, prior to stealth dicing. See claim 53.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such adhesive sheet as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, having the elastic modulus of the adhesive sheet in a B-stage state as in claims 2-4; and/or amount of acrylic rubber contained in the adhesive sheet as in claim 7, and more specifically, as in claims 50 and 51; and/or content of remaining volatile matters in the adhesive sheet, as in claim 10; and/or film thickness of the adhesive sheet, as in claim 11; and/or wherein the polymer component further includes epoxy resin (see claim 52).

The present invention is directed to an adhesive sheet, suitable for joining a semiconductor element with a semiconductor-element-mounting support member, and which adhesive sheet can be laminated together with dicing tape onto a wafer and is capable of being subjected to stealth dicing.

In recent years, various wafer-cutting methods have been suggested, for cutting the wafer into individual chips. Such methods include methods of processing the wafer so that, subsequently, the wafer can easily be cut. One technique is the step of forming modified regions of the wafer by radiating a laser into the wafer along lines intended to be cut; and, subsequently, cutting the wafer, by, for example, the application of external force thereto. This technique is the so-called stealth dicing technique. Note the paragraph bridging pages 3 and 4 of Applicants' specification.

In order to manufacture a semiconductor device according to a wafer-back-face sticking mode by use of, e.g., stealth dicing, it is necessary to cut an adhesive sheet and a wafer simultaneously. However, when conventional adhesive sheets are used, it is difficult to cut the sheet at the same time as a wafer is cut. When a non-elastic

adhesive sheet having a good breakability is used as the adhesive sheet, the adhesive sheet and wafer can be simultaneously cut in the state that cutting faces of the two are made substantially consistent; however, the non-elastic adhesive sheet has a low fluidity, and, therefore, the sheet is not easily stuck onto the wafer at relatively low temperatures of, e.g., 100°C or lower. Additionally, the adhesive sheet can be cracked, since the adhesive sheet itself is brittle.

Against this background, Applicants provide an adhesive sheet having the properties of being laminated together with dicing tape onto a wafer prior to stealth dicing, and which is capable of being subjected to stealth dicing discussed previously. Applicants have found that through use of the specific polymer component as in claim 1, the adhesive sheet having properties as in the present claims, the adhesive sheet can be used advantageously in, e.g., stealth dicing. When the adhesive sheet is laminated together with dicing tape onto a wafer and diced by stealth dicing, the adhesive sheet shows excellent breakability and laminating properties, as shown in Tables 1 and 4 on pages 34 and 46, respectively, of Applicants' specification.

In particular, as described on pages 5 and 6 of Applicants' specification, the present inventors have found out that when the breaking strength and the breaking elongation of an adhesive sheet in a B-stage state at 25°C are restricted into specific numerical ranges, in connection with specific sheets, the adhesive sheet has the property that it can be cut at the same time as a wafer is cut at room temperature. Furthermore, the inventors have found that in order for an adhesive sheet to keep flexibility at room temperature and be cut at the same time as a wafer is cut at room temperature, it is necessary that the elastic modulus of the adhesive sheet has a specific frequency dependency. The frequency dependency is a phenomenon that a

sample has an elastic modulus variable in accordance with the frequency of a strain applied to the sample in the measurement of dynamic viscoelasticity. Note the paragraph bridging pages 5 and 6 of Applicants' specification.

Yanagiuchi, et al. discloses an adhesive tape for painting, and method of manufacturing this tape, the tape being used for painting vehicles such as automobiles and motorcycles. The adhesive tape includes an adhesive layer having a top surface; a paint layer including paint and provided on the top surface of the adhesive layer; and a clear coating layer laminated on the paint layer. See column 1, lines 62-67. According to Yanagiuchi, et al., the painting adhesive tape has a paint layer formed of paint itself, so that quite the same finish as that obtained in the case where the paint is directly painted can be obtained. Note column 2, lines 1-9. See also column 3, lines 43-60, describing that the adhesive layer of the painting adhesive tape can be formed from conventionally used pressure-sensitive adhesives or heat-sensitive adhesives, examples of such adhesives including adhesives containing natural rubbers, acryl based resins, ethylene-vinylacetate copolymers, polyurethane, polyester, silicone rubbers, fluoro based rubbers, or polyvinylbutyral as their major component.

As can be seen from the foregoing, as well as from a full review of Yanagiuchi, et al., this patent relates to an adhesive tape for painting. It is respectfully submitted that this patent does not disclose, nor would have suggested, such adhesive sheet as in the present claims, having the recited characteristics as in the present claims including the property that the adhesive sheet can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing.

In Item 4 on page 3 of the Communication dated September 21, 2007, the Examiner notes various parameters of the adhesive layer, of the painting adhesive tape

of Yanagiuchi, et al., and contends that properties of the adhesive layer are encompassed by and overlap the presently claimed parameters. However, it must be emphasized that the present claims recite an adhesive sheet. Moreover, in contrast thereto, Yanagiuchi, et al. discloses an adhesive tape for painting including, in addition to an adhesive layer, a paint layer. It is respectfully submitted that the adhesive tape of Yanagiuchi, et al. would have neither taught nor would have suggested the adhesive sheet of the present claims, including properties thereof and advantages thereof.

The rejections of claims under 35 USC 102 or under 35 USC 103 as set forth on pages 8 and 9 of the Office Action mailed March 12, 2007, and in Item 5 on page 3 of the Communication mailed September 21, 2007, are noted. Ten references individually are applied in these rejections. As will be shown in the following, it is respectfully submitted that these references would have neither taught nor would have suggested such adhesive sheet as in the present claims, and advantages thereof.

Inada, et al. discloses an adhesive produced by preparing a varnish of a composition, the composition being described, for example, in column 4, lines 12-34 thereof.

Tomiyaama, et al. discloses an adhesive composition as described most generally in column 5, lines 19-48, and an adhesive film as described most generally in column 5, line 49 to column 6, line 15. The adhesive film is described as being a film that connects a semiconductor chip and a substrate, or connects semiconductor chips themselves, as described in column 5, lines 49-53.

It is respectfully submitted that neither of Inada, et al. or Tomiyama, et al. discloses adhesive sheets used for stealth dicing; or, more particularly, having properties as in the present claims, such that the adhesives can be used for stealth

dicing. It is respectfully submitted that these references do not consider about breakability and laminating properties, achieved according to the present invention.

Shimada, et al. discloses an adhesive composition for multilayer wiring boards for mounting a semiconductor device, the adhesive composition being described, for example, in column 2, lines 28-62 thereof.

As with Inada, et al. and Tomiyama, et al., it is respectfully submitted that Shimada, et al. does not consider breakability and laminating properties of the adhesive sheets; and it is respectfully submitted that this reference does not disclose, nor would have suggested, the combination of specific polymer component and properties, providing an advantage in application for stealth dicing.

Tanaka, et al. discloses an adhesive, in columns 3 and 4 of the patent, including an epoxy resin and a hardener therefor, together with a latent curing accelerator and an epoxidized acrylic copolymer. The glass transition temperature and weight average molecular weight of the epoxidized acrylic copolymer are disclosed.

Teiichi, et al. discloses an adhesive composition for use in mounting semiconductors, the adhesive composition being described on page 2 of this patent document, e.g., in paragraph [0017] thereof.

It is respectfully submitted that neither of Tanaka, et al. or Teiichi, et al. would have disclosed or would have suggested the adhesive sheet of the present claims, having the specific component of the specified acrylic rubber, and the properties such that the sheet has advantages in stealth dicing, including breakability and laminating properties.

Attention is also directed to the four Japanese patent documents applied by the Examiner on page 8 of the Office Action mailed March 12, 2007.

No. 9-298369 discloses an adhesive layer for a multilayer wiring board, having a specific modulus of elasticity and including an epoxy resin and a phenolic resin together, together with a high-molecular-weight resin which is compatible with the epoxy resin, a rubber whose weight average molecular weight is 100,000 or higher, and a hardening promoter.

No. 9-302313 discloses an adhesive or bonding sheet including liquid epoxy resin and its curing agent, a high-molecular-weight resin, curing accelerator, and coupling agent, for use in preparing a multilayered wiring board.

No. 2000-248025 discloses acrylic resins suitably used for adhesives and adhesive films having various properties required when installing semiconductor chips having large differences in heat expansion coefficients to various high density printed circuit boards.

No. 2002-060716 discloses a low-elastic adhesive having heat and moisture resistances required for packaging a semiconductor chip having a great difference in coefficient of thermal expansion in a wiring substrate, this adhesive including an epoxy resin and curing agent therefor, an epoxy group-containing acrylic copolymer having specified glass transition temperature and number-average molecular weight, a curing accelerator, silicone rubber filler and a coupling agent.

It is respectfully submitted that none of the applied Japanese patent documents disclose or would have suggested properties for stealth dicing as in the present claims, and, in particular, do not disclose, nor would have suggested, an adhesive sheet as in the present claims, having the specific polymer component, and having advantageous breakability and laminating properties for stealth dicing, wherein the adhesive sheet has

the property that it can be laminated together with dicing tape onto a wafer prior to dicing and is capable of being subjected to stealth dicing, as in the present claims.

The contention by the Examiner as to inherency of properties, set forth in Item 11 on page 8 of the Office Action mailed March 12, 2007, is noted. It is emphasized that the compositions of the references applied as prior art include many different materials, having effects on properties of the composition. In view of the specifically disclosed compositions of the prior art, including components in addition to those in the present claims, it is respectfully submitted that the Examiner has not established inherency.

The contention by the Examiner in the last four lines on page 3 of the Communication mailed September 21, 2007, that the claim language of the capability of the adhesive sheet “merely indicates the ultimate intended utility of the adhesive sheet and is not a critical limitation” is respectfully traversed. Clearly, such claim language, of the claims as presently amended, recite a property of the adhesive sheet, which constitutes a structural recitation which must be considered in determining patentability. Noting especially that this property is recited in a “wherein” clause at the end of claim 1 (e.g., not in the preamble), it is respectfully submitted that the Examiner must give weight to this “wherein” clause in a determination of patentability of the presently claimed subject matter.

In view of all of the foregoing comments and amendments, entry of the present amendments (as a complete response to the Office Action mailed March 12, 2007), and reconsideration and allowance of all claims presently pending in the above-identified application, are respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP,

Deposit Account No. 01-2135 (case 1204.45675X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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Enclosures: Electronic Acknowledgement Receipt; Electronic Patent Application Fee Transmittal

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